

### **REMARKS**

Claims 1-36 are all the claims pending in the application, claims 35 and 36 having been added to claim the disclosed invention more clearly.

The Examiner indicated that Figure 10 should be designated by a legend such as –Prior Art –, as required by MPEP § 608.02(g). In response, Applicant submits herewith a Replacement Sheet with –Prior Art—placed in the appropriate location.

Applicants notes the drafts person's objections to the drawing figures. Formal drawing figures, free of the listed deficiencies, will be submitted in timely fashion.

The Examiner has objected to the title of the invention. Applicant submits the foregoing amended title.

The Examiner has also objected to claims 7, 8, 10-16 and 20-34 as being improper multiple dependent claims. The foregoing claim amendments are believed fully responsive to this objection, and Applicant requests that these claims be considered on their merits.

Claims 1-6, 9 and 17-19 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite. Claims 17-19 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Ma et al. (hereinafter Ma) (U.S. patent No. 5,517,043) in view of Wen (U.S. patent No. 4,873,561). Applicant respectfully traverses these rejections, and requests reconsideration and allowance of the pending claims in view of the following arguments.

### **Rejection Under 35 U.S.C. §112**

The forgoing amendments to claims 1-6, 9 and 17-19 are believed responsive to the points raised by the Examiner in this rejection. However, Applicant provides the following comments.

With regard to claim 1, the Examiner stated that it is unclear as to how many electromagnetic waves are being claimed. Claim 1 utilizes the term “an electromagnetic wave” to

denote a single wave. Those skilled in the art commonly refer to a single electromagnetic wave, in contrast to a plurality of “electromagnetic waves.” Furthermore, it is proper to utilize the single electromagnetic wave terminology as long as the frequency remains constant and only the amplitude is modulated according to a given modulation function, such as a sinusoidal or pseudo random modulation. Accordingly, use of the single electromagnetic wave terminology is readily understood by those skilled in the art and therefore does not render this claim indefinite. The Examiner also indicated that it was unclear as to what is meant by the term “ $U_0$ .” Claim 1 has been amended to clarify that this term represents the bias voltage of the accumulation gates ( $G_a$  and  $G_b$ ).

Concerning claim 2, the Examiner stated that it was unclear if the “intensity-modulated” electromagnetic wave is the same wave as recited in claim 1, or if these claims recite different waves. The foregoing amendment to claim 2 clarifies that the same electromagnetic wave is being recited in both claims.

With regard to many of the remaining claims that were rejected under § 112, the Examiner indicated that the term “the electromagnetic wave” lacked proper antecedent basis. Applicant disagrees and respectfully points out that the term “the electromagnetic wave” recited in the dependent claims at issue refers to the same electromagnetic wave that is recited in the first element of claim 1, and therefore this term has sufficient antecedent basis.

With regard to claim 9, Applicant is unsure as to the specific reasons why this claim has been rejected since no reason has been provided. Applicant assumes that the term “the difference image” has been rejected as lacking proper antecedent basis and this claim has been amended to correct this deficiency. However, Applicant is unable to discern any correctable error with the “photogate voltages” term. Accordingly, Applicant requests clarification for this particular claim rejection.

The foregoing claim amendments and comments are believed fully responsive to the points raised in the Office Action, and accordingly, Applicant requests reconsideration and withdrawal of the rejection to claims 1-6, 9 and 17-19.

**Rejection Under 35 U.S.C. §103(a)**  
**Over Ma in view of Wen**

To establish a *prima facie* case of obviousness, the Examiner bears the burden of demonstrating that (1) there is some suggestion or motivation to modify the reference or to combine reference teachings; (2) there is a reasonable expectation of success; and (3) the prior art reference (or references when combined) must teach or suggest all the claim limitations. *See* M.P.E.P. § 2142.01 (citing *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)).

Independent claim 17 is directed to a photonic mixing element that includes at least two light-sensitive modulation photogates. As amended, the modulation photogates also comprise terminals adapted to receive modulation photogate voltages.

The Examiner asserts that FIG. 4 of Ma teaches the use of two modulation photogates, and specifically refers to photogates 404 and 406 as providing this teaching. Applicant's review of this reference finds that photogates 404 and 406 are not "modulation photogates," as the Examiner asserts, but rather represent "accumulation photogates." For example, Ma describes photo-generated charges that are accumulated under the accumulation photogates 404 and 406, and which are subsequently transferred to the readout gate 410 (Ma at col. 4, line 62 – col. 5, line 10). The readout gate 410 reads out a signal value that is proportional to the amount of light incident on the device. The buried drains 400 and 402, which are adjacent to the accumulation

photogates 404 and 406, are passive drains into which excess carriers are spilled under saturation conditions during illumination with high intensity (Ma at col. 5, lines 11-15).

Although Ma discloses the use of *accumulation* photogates in a CCD pixel, this reference does not teach or suggest the use of *modulation* photogates, or the use of terminals than can receive modulation photogate voltages, as recited in claim 17. Furthermore, the potential barrier regions 408 of the device described in Ma would indeed prevent the flow of photocharge from the accumulation areas into the buried drains 400 and 402, and as such, would render the Ma device incapable of functioning as a photonic mixing element.

Applicant's review of Wen finds that this reference does not remedy the deficiencies of Ma. Applicant therefore asserts that all of the claim limitations of independent claim 17 are not taught or suggested by Ma and Wen and submits that the Examiner has failed to make out a *prima facie* case for obviousness. Accordingly, independent claim 17, as well as dependent claims 18 and 19, are believed to be patentable.

Applicant further notes that claims 20-25, which the Examiner has objected to in the present Office Action, have not been substantively examined. However, Applicant submits that these claims are also believed patentable at least by virtue of their dependence on independent claim 17.


Lastly, Applicant acknowledges that claims 35 and 36 have not been formally rejected because they are being submitted in the instant Amendment. However, these claims are also believed to be patentable at least by virtue of their dependence on patentable independent claims 1 and 30, respectively.

### CONCLUSION

Applicant believes that the Examiner's rejections have been overcome and submits that the subject application is in condition for allowance. Should any issues remain unresolved, the Examiner is invited to telephone the undersigned attorney.

Respectfully submitted,

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